before the American Metrological Society, December 30, 1892, by the President, Dr. B. A. Gould.

Bulletin de l'Académie Royale de Belgique, No. 1, 1893.—On Poisson's law of large numbers, by P. Mansion.—On the influence of time upon the mode of formation of the meniscus at the temperature of transformation, by P. de Heen. If a sealed glass tube is partly filled with carbonic acid in the liquid state, and then heated slightly above the critical temperature, the meniscus forming the surface of separation gradually disappears until all the liquid is converted into vapour. But for some time after this has taken place the density of the substance above the surface of separation is less than that below, as may be seen by the appearance of a generating line. If the tube is withdrawn from the water bath at 33°, the formation of a small cloud is observed in the region where the meniscus disappeared, and the latter is gradually reproduced in the same place. The phenomenon is not observed when the tube is inverted, or kept at 33° for 24 hours, thus allowing the two constituents to mix by diffusion. —Two experimental verifications relating to crystalline refraction by J. Verschaffelt.—Crystallographic note on the axinite of Quenast, by A. Franck.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, February 24.—Prof. A. W. Rücker, F.R.S., President, in the chair.—Mr. Everett, junr., read a paper on a new and handy focometer, by Prof. J. D. Everett, F.R.S., and exhibited the instrument described. The focometer is constructed on the principle of the "Lazy tongs," and so arranged that the distance between the object and screen can be varied whilst the lens is automatically kept midway between the two. This gives sharpest definition and the simplest calculation. The lazy tongs has eight cells, formed by eighteen bars $13'' \times \frac{3}{4}'' \times \frac{1}{4}''$, and is capable of being extended to about eight feet, or closed up to about one foot. Brass pins about $\frac{1}{4}''$ diameter and one and half inches long project upward from each joint in the middle row, and serve as supports for clips carrying the lens, object, and screen. The instrument can be used for any lens whose focal length lies between twenty-four inches and one inch or less. Details respecting the most appropriate objects and screens, and practical hints about the working of the instrument are given in the paper. The question of what accuracy is obtainable is also briefly discussed.—Mr. A. Hilger thought the instrument was too flexible to be used for accurate work.—Mr. Blakesley suggested that by using a plane mirror close behind the lens the light would be reflected back, and the length of the focometer could be reduced by one-half.—The President thought Prof. Everett never intended the instrument to compete, as regards accuracy, with the elaborate and expensive apparatus now used, but nevertheless the focometer was a very valuable one, especially for students' work, and was particularly well adapted to impress upon them the facts relating to conjugate foci.—A paper on a hydrodynamical proof of the equations of motion of a perforated solid, with applications to the motion of a fine framework in circulating liquids, by G. H. Bryan, M.A., was read by Dr. C. V. Burton. The object of the paper, which is a mathematical one, is to show how the equations may be deduced directly from the pressure-equation of hydrodynamics, without having recourse to the laborious method of "ignoration" of co-ordinates. The results are applied to determine the motion of a light framework of wires. When the framework has a single aperture it is shown that no force produces motion in its own direction, and no couple produces rotation about its own axis. In the case of a fine massless circular ring the direction of whose axis is taken as the axis of x, a constant force along the axis of y produces uniform rotation about the axis of z, and a constant couple about the axis of y produces uniform translation along the axis of z. In conclusion the author states that the results might be made to furnish mechanical explanations of certain physical phenomena. The President said the author had done good service by attacking the difficult problem by elementary methods. —Dr. C. V. Burton made a communication on plane and spherical sound-waves of finite amplitude. The first part of the paper refers to plane waves. This subject had been considered by Riemann, but Lord Rayleigh had criticised that part of Riemann's work, where it is held that a state of motion is possible in which the fluid is divided into two parts by a surface of discontinuity propagating itself with constant velocity, all the fluid on one side of the surface of discontinuity being in one uniform condition as to density and velocity, and on the other side a second uniform condition in the same respects. After quoting Lord Rayleigh's criticisms the author shows that the same objection applies when the velocity and density on either side of the surface may vary continuously in the direction of propagation, and the velocity of propagation of the surface of discontinuity is also allowed to vary. In each case the assumed motion violates the condition of energy, and can only exist under that special law of pressure for which progressive waves are of accurately permanent type. Inquiry is then made as to what becomes of waves of finite amplitude after discontinuity sets in (which condition must always occur with plane waves), in the course of which it is pointed out that the front of an air disturbance produced by a moving source which starts impulsively, travels faster than the source, even if the velocity of the source exceeds that of feeble sounds. A mechanical analogy suggests that a dissipative production of heat takes place when discontinuity occurs. In all cases Riemann had assumed that the pressure is a function of density only according to the isothermal or adiabatic law, and thus failed to take account of any heat which may be dissipatively produced. Part II. of the paper deals with spherical waves, and contains a mathematical investigation into the conditions under which the motion remains continuous or becomes discontinuous. The criterion is found in the finitude or infinitude of a certain integral. It is shown that if viscosity be neglected, then under any practically possible law of pressure the motion in spherical sound waves always becomes discontinuous. For waves diverging in four dimensions some cases occur in which the motion remains continuous. The general question of spherical sound waves of finite amplitude is then treated of, and the paper concludes with a method of finding the differential equation of an infinitesimal spherical disturbance which is superposed on a purely radial steady motion. Prof. A. S. Herschel inquired whether the nature of the solution for plane waves of finite amplitude was similar to that for ordinary waves-motion? In the latter case everything depended on the instantaneous impulses, for these alone determined the nature of the wave. The President said Mr. Boys' experiments on flying bullets might have some bearing on Dr. Burton's paper. If the conclusions there stated were correct, then the velocity of the air in front of a bullet should be greater than that of the bullet, even if the latter was travelling faster than ordinary sound waves. He now asked Mr. Boys if his photographs gave any evidence of this. Mr. Boys said the fact that the photographs showed disturbances in front of the bullet proved that the disturbance travelled faster. In one case where a large bullet was moving at a velocity rather greater than that of ordinary sound in the medium, the front of the disturbance was about half an inch in advance of the bullet. In another instance where the bullet was smaller and the velocity greater, the distance which the disturbance was in advance of the bullet was somewhat less. In all cases, even when the velocity of the bullet was four times that of sound, the character of the effects remained the same. Dr. Burton replied to the points raised.

March 10.—Prof. A. W. Rücker, F.R.S., President, in the chair.—Dr. C. V. Burton read a paper on the applicability of Lagrange's equations of motion to a general class of problems, with special reference to the motion of a perforated solid in a liquid. The paper shows that to apply Lagrange's equations it is not always necessary that the configuration of the system should be completely determined by the co-ordinates, but that under certain conditions one need not consider whether the whole configuration is determined by the nature of the known co-ordinates, nor inquire what is the nature of the ignored co-ordinates. The result, which is arrived at by the aid of the "principle of least action," and the investigation given in Thomson and Tait's "Natural Philosophy," second edition, part i. § 327, is expressed by the following proposition:—If the kinetic energy of a material system can be expressed as a homogeneous quadratic function of certain generalised velocities $\dot{\psi}, \dot{\phi}, \ldots$ only, the co-efficients being functions of $\psi, \phi, \ldots$ only, and if this remains always true so long as the only forces and impulses acting are of types corresponding to $\psi, \phi, \ldots$, the equations of motion for the co-ordinates $\psi, \phi, \ldots$ may be written down from this expression for the energy in accord-

ance with the Lagrangian rule. The author then applies the proposition to the case of a perforated solid with liquid irrotationally circulating through the apertures, and shows how it may be extended to any number of perforated solids. Incidentally it is mentioned that in equations $(10)^{v}$ and $(10)^{vi}$ (Thomson and Tait, part i. § 327) the sign of $\partial\nu/\partial\psi$ should be reversed. A difficulty which arises in applying the result of § 319, example G, in the same work, to the motion of solids through liquids is also referred to. A criticism by Mr. A. B. Basset on Mr. Bryan's recent paper and also on Dr. Burton's paper was read by Mr. Elder. Mr. Basset regards the process employed by Mr. Bryan in obtaining the equations of motion as a distinctly retrograde step, and thinks the most scientific way of dealing with dynamical problems is to avoid the unnecessary introduction of any unknown reactions. The advantages of the theory of the impulse are described by Mr. Basset, and the parts which require care when applying the theory to cyclic irrotational motion pointed out. Comparisons are then made as regards simplicity, between the different methods of treating the subject which have been used by Mr. Bryan, Prof. Lamb, and himself. With reference to Dr. Burton's paper he thinks it will tend to complicate rather than elucidate the subject. An account of how Lagrange's original equations had been modified by Hamilton, Routh, and himself is given at some length, and the advantages and power of the mixed transformation, which he had developed are pointed out. Prof. Henrici said he agreed with Mr. Basset in preferring the more general method, but thought the independent treatment of special problems as given by Mr. Bryan and Dr. Burton, very desirable.—Dr. Burton in reply said he concurred with Mr. Basset on some points, but thought it decidedly advantageous to look at problems from different points of view. The investigation he (Dr. Burton) had given was applicable to any number of solids, and on the whole simpler than Mr. Basset's. The President pointed out that no attack had been made on the validity or accuracy of Mr. Bryan's or Dr. Burton's work. As to simplicity of the various methods, different opinions might be expected to exist. He himself thought it very desirable that such problems should be approached from different sides.—Prof. G. M. Minchin read a paper on the magnetic field of a circular current.—A paper on the differental equation of electric flow, by Mr. T. H. Blakesley, was postponed.

Royal Microscopical Society, February 15.—Mr. A. D. Michael, President, in the chair.—Mr. E. M. Nelson exhibited a microscope made by Messrs. Watson, to which several novelties had been applied.—Mr. J. W. Lovibond read a note on the measurement of direct light by means of the tintometer. Mr. Nelson said that the wonderful results obtained by the author by means of his instrument were perfectly surprising. It was, in fact, equal to discovering differences down to millionths of a tint; having had the pleasure of seeing and using it he soon found that there was a very decided difference in the colour sensation of his own eyes, which until that time he had never suspected. It had done such marvels when applied to macroscopic purposes that he did not doubt it would do much also when applied to microscopic studies.—Mr. G. S. Marriott's form of mounting and dissecting stand was exhibited and described by Mr. Nelson.—Mr. T. F. Smith read a paper on the use of monochromatic yellow light in photomicrography.—Prof. F. J. Bell read a letter from Dr. H. G. Piffard bearing on the same subject.—A paper descriptive of two species of rotifers by Mr. J. Hood was also read by Prof. Bell.—Mr. Nelson read a paper on the chromatic curves of microscope objectives.—Dr. W. H. Dallinger said that Mr. Nelson was quite right in pointing out that unless we could devise means for employing the shorter wave-lengths of the spectrum we had approached very near to the limits of visual possibility with the means at present at our disposal. But as to the belief expressed by Mr. Nelson that glass such as was used in our objectives was not transparent to the higher violet and ultra-violet rays, and to some extent also to the blue, it must be remarked that there could be no doubt but that the figures of the lenses had much to do with this; it led them up to the consideration of the question as to what would be a suitable form and medium for lenses capable of allowing the higher rays to be used. There could be little doubt that all who believed in a future advantage in the use of monochromatic light foresaw that there must be lenses specially prepared for its use. They all knew now that they had reached the limit of possibility so far as present materials were concerned; for if a lens could be made with a N.A. of 2·00, there was no liquid medium to use with it, because no medium so employed would be tolerant of living or even organic substances. If, therefore, they could by some means use shortened wave-lengths, they would have accomplished something extremely useful.—The rest of the agenda was postponed in consequence of the lateness of the hour.

Entomological Society, March 8.—Capt. Elwes, President, in the chair.—Herr Pastor Wallengren, of Farhult, bei Höganäs Sweden, and Herr Hofrath Dr. Carl Brunner Von-Wattenwyl, of Vienna, were elected Honorary Fellows of the Society to fill the vacancies in the list of Honorary Fellows caused by the deaths of Prof. Hermann C. C. Burmeister and Dr. Carl August Dohrn.—Dr. D. Sharp, F.R.S., exhibited a fine species of *Enoplotrupes* from Siam, which was believed to be new, and which he thought Mr. Lewis intended to describe under the name of *E. principalis*. This insect has great power of making a noise, and the female seemed in this respect to surpass the male.—Mr. W. F. H. Blandford said he wished to supplement the remarks which he made at the meeting of the Society on February 8 last, on the larva of *Rhynchophorus*. He stated that he had since found that only the first seven pairs of abdominal stigmata were rudimentary. The posterior pair were well developed and displaced on to the dorsum of their segment, which was thickly chitinised, and bore a deep depression, on the margins of which the spiracles were situated. He added that dissection showed that the posterior pair were the principal agents of respiration.—Mr. W. H. B. Fletcher exhibited a long series of bred *Zygæna loniceræ* and *Z. trifolii*, hybrids of the first generation with the following parentage:—*Z. loniceræ*, male—*Z. trifolii*, female; *Z. trifolii*, male—*Z. loniceræ*, female; also hybrids of the second generation between *Z. trifolii*—hybrid, and *Z. loniceræ*—hybrid. He stated that many of the hybrids were larger than the parent species, and that some hybrids between *Z. loniceræ* and *Z. filipendulæ* were the largest he had ever seen. He added that *Zygæna meliloti* would not hybridise with *Z. loniceræ*, *Z. trifolii* or *Z. filipendulæ*.—Mr. F. W. Frohawk exhibited a bred series of *Vanessa atalanta*, showing the amount of variation in the red band on the fore wings of the female.—Capt. Elwes exhibited a large number of specimens of *Chrysophanus phlæas* from various places in Europe, Asia, and North America, with the object of showing that the species is scarcely affected by variations of temperature, which was contrary to the opinion expressed by Mr. Merrifield in his recent paper on the effects of temperature on colouring. Mr. McLachlan, F.R.S., Mr. A. J. Chitty, Mr. Bethune-Baker, Mr. Tutt, and Mr. Barrett, took part in the discussion which ensued.—Dr. Sharp read a paper entitled "On Stridulating Ants." He said that examination revealed the existence in ants of the most perfect stridulating or sound-producing organs yet discovered in insects, which are situated on the 2nd and 3rd segments of the abdomen of certain species. He was of opinion that the structures which Sir John Lubbock thought might be stridulating organs in *Lasius flavus* were not really such, but merely a portion of the general sculpture of the surface. Dr. Sharp said that the sounds produced were of the greatest delicacy, and Mr. Goss had been in communication with Mr. W. H. Preece, F.R.S., with the view of ascertaining whether the microphone would assist the human ear in the detection of sounds produced by ants. Mr. Preece had stated that the microphone did not magnify, but merely reproduced sound, and that the only sounds made by ants which he had been able to detect by means of the instrument were due to the mechanical disturbance produced by the motion of the insects over the microphone. A long discussion ensued, in which the President, Canon Fowler, and Messrs. Champion, McLachlan, Goss, Hampson, Barrett, Burns, and Jacoby, took part.—Mr. C. J. Gahan read a paper entitled "Notes on the Longicornia of Australia and Tasmania, Part I.; including a list of the species collected by Mr. J. J. Walker, R.N."

Geological Society, March 8.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read:—On the occurrence of boulders and pebbles from the glacial drift in gravels south of the Thames, by Horace W. Monckton. North of the Thames near London, the glacial drift consists largely of gravel, which is characterised by an abundance of pebbles of red quartzite and boulders of quartz and igneous

rock. With the exception of very rare boulders of quartz, the hill and valley-gravels of the greater part of Kent, Surrey, and Berkshire are entirely free from these materials. The author points out that the river Thames is not, however, the actual southern boundary of the distribution of these glacial drift pebbles and boulders, though the number of localities where they are found in gravels south of that river is few. The author describes or mentions several, of which the following are the most important:—Tilehurst, Reading, Sonning, Bisham at 351 feet above the sea, Maidenhead, Kingston, Wimbledon, and Dartford Heath.—On the plateau-gravel south of Reading, by O. A. Shrubsole. This paper contains observations on the gravel of the Easthampstead-Yately plateau. The constituent elements of the gravel are described, and the author notes pebbles of non-local material near Cæsar's Camp, Easthampstead, on the Finchampstead Ridges, and at Gallows Tree Pit at the summit of the Chobham Ridges plateau. He mentions instances of stones from the gravel of the plateau (described in the paper) which may bear marks of human workmanship. He furthermore argues that the inclusion of pebbles of non-local origin in the gravels may be due to submergence of the plateau up to a height of at least 400 feet above present sea-level, and cites other facts in support of this suggestion. He concludes that the precise age of the gravel can only be more or less of a guess, until the mode of its formation has been definitely ascertained. The reading of these papers was followed by a discussion, in which the President, Dr. Hicks, Mr. J. A. Brown, Prof. J. F. Blake, Mr. W. J. L. Abbott, Mr. Herries, Mr. Monckton, and Mr. Shrubsole took part.—A fossiliferous pleistocene deposit at Stone, on the Hampshire Coast, by Clement Reid. (Communicated by permission of the Director-General of the Geological Survey.) This is practically a supplement to a paper on the pleistocene deposits of the Sussex coast, that appeared in the last volume of the *Quarterly Journal*. An equivalent of the mud-deposit of Selsey has now been discovered about twenty miles farther west, and from it have been obtained elephant-remains, and some mollusca and plants like those found at Selsey. Among the plants is a South European maple. Some remarks were made on the paper by the President, Dr. Hicks, and Mr. W. J. L. Abbott, and the author replied.

Zoological Society, March 14.—Sir W. H. Fowler, F.R.S., President, in the chair.—The Secretary read a report on the additions that had been made to the Society's menagerie during the month of February, 1893, and called attention to two terrapins procured on Okinawa Shima or Great Loochoo Island by Mr. P. A. Holst, and kindly presented by that gentleman. Mr. Boulenger had determined these tortoises as being Spengler's terrapin (*Nicoria spengleri*).—Mr. O. Thomas exhibited and made remarks on a rare antelope (*Nanotragus livingstonianus*) from Northern Zululand.—Dr. Forsyth-Major exhibited and made remarks on a tooth of *Orycteropus* from the Upper Miocene of Maragha, Persia, which he referred to *O. gaudryi*, of the Upper Miocene of Samos. Drawings of the remains of the latter were exhibited, as well as a photograph of a femur of a struthious bird from the same deposit in Samos. The habitats of *Struthio* and *Orycteropus* were thus shown to have been essentially identical in past times, as in the present. Therefore the general conclusions to be drawn from their geographical distribution would apply equally to both.—Mr. Oldfield Thomas made some suggestions for the more definite use of the word "type" and its compounds, as denoting specimens of a greater or less degree of authenticity.—Mr. P. L. Sclater, F.R.S., pointed out the characters of a new African monkey of the genus *Cercopithecus*; and took the opportunity of giving a list of the species of this genus known to him, altogether 31 in number, together with remarks on their exact localities.—Prof. F. Jeffrey Bell read a paper on *Odontaster* and the allied and synonymous genera of the Asteroidea.—Mr. A. D. Michael read a paper upon a new species (and genus) of *Acarus* found in Cornwall. The creature in question, which it was proposed to call *Lentungula algivorans*, was found in some quantity on a green alga (*Cladophora fracta*) near the Land's End. It was a minute creature belonging to the family Tyroglyphidæ, the remarkable feature about it being that, whereas the two hind pairs of legs were terminated by a hard and powerful single claw (which claw sprang from the end of the tarsus), the two front pairs had the tarsus itself hardened and curved strongly downward, forming clinging- and walking-organs; while from the side of the tarsus sprang a long peduncle, flexible in all directions at the will of the creature, and bearing an exceedingly minute claw. This apparatus was not used in climbing, but had become wholly tactile. Such an arrangement was previously unknown in the Acarina.—Prof. Howes described some abnormal vertebræ of certain Ranidæ (*Rana catesbiana*, *R. esculenta*, and *R. macrodon*) in which the so-called "atlas" possessed transverse processes and trans-atlantal nerves. Prof. Howes discussed the bearings of these specimens on the morphology of the parts, deducing the argument that the first vertebra of the Amphibia is probably to be regarded as a representative of at least two vertebræ, of which the formative blastema has become merged in the occiput in the Amniota. The author also described a stage in the development of the urostyle of *Pelobates*, and showed that, in this Batrachian, there is a provisional inversion in the order of development of the parts of the urostyle and precoccygeal vertebræ. He also described a reduced hind limb of *Salamandra maculosa*, in which the reduction and fusion of the parts remaining realised the condition normal for the Urodele limb with numerically reduced digits.

Royal Meteorological Society, March 15.—Dr. C. Theodore Williams, President, in the chair.—Mr. Shelford Bidwell, F.R.S., delivered a lecture on some meteorological problems, which was illustrated with numerous photographs and experiments. The lecturer said that one of the oldest and still unsolved problems of meteorology relates to the origin of atmospheric electricity. Many possible sources have been suggested, among them being the evaporation of water and the friction of dust-laden air against the earth's surface. Having granted some sufficient source of electrification, Mr. Bidwell said that it is not difficult to account for the ordinary phenomena of thunderstorms. Photography has shown that the lightning flash of the artists, formed of a number of perfectly straight lines arranged in a zig-zag, has no resemblance to anything in nature. The normal or typical flash is like the ordinary spark discharge of an electrical machine, it follows a sinuous course, strikingly similar to that of a river as shown upon a map. The several variations from the normal type all have their counterparts in the forms taken by the machine spark under different conditions, and the known properties of these artificial discharges may be assumed to afford some indication as to the nature of the corresponding natural flashes. Thus, for example, the ramified or branched flash, from which no doubt the dreaded "fork lightning" derives its name, is probably one of the most harmless forms of discharge. Ever since the time of Franklin it has been customary to employ lightning rods for the protection of important buildings. According to Dr. Oliver Lodge these are of no use in the case of an "impulsive rush" discharge, which, however, is of comparatively rare occurrence. Lightning conductors, however well constructed, cannot therefore be depended upon to afford perfect immunity from risk. Mr. Preece is of opinion that the "impulsive rush," though easily producible in the laboratory, never occurs in nature. Mr. Bidwell made some remarks as to the duration of a lightning flash and the causes of its proverbial quiver, and suggested an explanation of the characteristic darkness of thunder clouds, and of the large rain-drops which fall during a thunder shower. The lecturer concluded with some observations concerning the probable cause of sunset colours, which he attributed to the presence of minute particles of dust in the air.

OXFORD.

University Junior Scientific Club, March 1.—The President in the chair.—Mr. C. H. H. Walker exhibited some compounds of the rare metals from the collection of the late Duke of Marlborough, which had been presented to the University by the Duchess.—Among the papers read was one by Dr. Leonard Hill on cortical localisation.

March 10.—The President in the chair.—Adjourned discussion on Dr. L. E. Hill's paper on cortical localisation.

CAMBRIDGE.

Philosophical Society, February 27.—Prof. T. McK. Hughes, President, in the chair.—The following communications were made to the Society:—On the histology of the blood of rabbits which have been rendered immune to anthrax, by Lim Boon Keng. The research was conducted in the pathological laboratory of the University. The rabbits were rendered

immune to anthrax by inoculation with the lymph and blood of frogs which had been subjected to various treatment. Previous observers had succeeded in conferring immunity with the use of similar substances. The object of the investigation, however, was to ascertain the changes in the character and relative number of the white cells of the blood after protective vaccination and after the introduction of virulent anthrax. From four to several hours after the injection of the vaccine a great increase in the number of the white cells is noticeable; and the most remarkable feature is the augmentation in number of the coarsely granular (eosinophile) corpuscles. The relative proportion in the numbers of the different varieties of cells is therefore altered, so that instead of forming only from 2 to 4 per cent. of the total number of white cells, the eosinophile corpuscles now constitute about 10 to 25 per cent. This increase persists only a short time, and on the third day the cells may have returned to a normal condition; and at this stage hyaline cells ingesting granular cells may be detected in numbers in certain localities. Although the blood has thus apparently returned to the normal condition, it is found that the state of eosinophile leucocytosis is rapidly reproduced on the introduction of virulent anthrax. After inoculation with a virulent culture of the microbes, the eosinophile cells appear in great numbers, so that they may form 50 per cent. of the white corpuscles, and in one instance an even higher percentage was found. These cells are not only increased in number but are also larger and have larger granules. Similar changes were observed in guinea pigs rendered immune by Dr. Haffkine to the common bacillus. In non-vaccinated rabbits the introduction of anthrax causes profound leucocytosis, but the cells are all very small and the eosinophile corpuscles are only slightly increased in number. General infection occurs in 36 to 48 hours, rapidly followed by death.—On numerical variation in digits, in illustration of a principle of symmetry, by Mr. W. Bateson. An account was given of cases of variation in number of digits so occurring that the parts are symmetrical about a new axis in the limb. Of these the phenomena seen in the bones of a number of polydactyle cats were chiefly important. The normal hind foot of the cat has four toes, each bearing a claw retracted by an elastic ligament to a notch on the *external* side of the second phalanx. This circumstance differentiates digits formed as lefts from those formed as rights. As extra digits are added on the internal side of the limb the symmetry changes. The limb being taken as a *right*, the variations seen are as follows: (1) Hallux present, making five digits: index is then *intermediate between right and left*. (2) Six digits present, internal having two phalanges: the three external digits are then normal rights, *the next two are formed as lefts;* the internal, having a non-retractile claw, is indifferent. (3) Six digits present, internal having three fully-formed phalanges and rectractile claw: the three externals are then normal rtghts, and *the three internals are formed as left digits*, thus forming two groups in bilateral symmetry about an axis passing between the digits having the relations of index and medius. Several cases of "double hand" in Man form a similar progressive series, and analogous facts in other animals were instanced.

PARIS.

Academy of Sciences, March 13.—M. Lœwy in the chair.—On the true theory of waterspouts and tornadoes, with special reference to that of Lawrence, Massachusetts, by M. H. Faye. The tornado which ravaged the town of Lawrence on July 26, 1891, was observed to descend to the earth and reascend four times during its passage over a tract of country seventeen miles long. After each temporary ascent to the clouds no effect was produced on the land just below. This fact tends to confirm M. Faye's theory, according to which tornadoes, waterspouts, and cyclones have their origin not in hot convection currents from the soil, but in disturbances in the higher strata of the atmosphere. The observed cases of upward suction of heavy objects are explained as effects of the reflection of downward currents by the soil.—On an electric furnace, by MM. Henri Moissan and Jules Violle (see "Notes").—The pancreas and the nervous centres controlling the glycemic function; experiments tending to exhibit the parts played by each of these agents respectively in the formation of glycose by the liver, by MM. A. Chauveau and M. Kaufmann.—Description of a new species of bilateral Holothuria (*Georisia ornata*), by M. Edmond Perrier.—On the observation of the shadows of Jupiter's satellites, by M. J. J. Lauderer.—On the formulæ for annual aberration, by M. Gaillot.—On the transcendentals defined by the differential equations of the second order, by M. Paul Painlevé.—A theorem of infinitesimal geometry, by M. G. Kœnigs.—New semicircular interference fringes, by M. G. Meslin.—Photography of certain phenomena furnished by combinations of gratings, by M. Izarn. On placing a lens with large radius of curvature upon a grating, broad rings, concentric with the Newton's rings observed at the same time, were seen and fixed photographically by means of a layer of sensitised gelatine poured over the lens. On placing one photographic copy of a grating upon another of the same grating, a series of more or less rectilinear fringes was observed, running on the whole transversely to the rulings. A similar phenomenon is described by Brewster in the *Philosophical Magazine* of 1856.—Photographic properties of cerium salts, by MM. Auguste and Louis Lumière. Cerium gives rise to two principal types of salts, cerous and ceric. The former are very stable, the latter are easily reduced, the organic salts being so easily reduced that they cannot be isolated. The best photographic results were obtained with ceric sulphate and nitrate. Paper was soaked in aqueous solutions of these salts and exposed to light under a transparency obtained from a negative. Where the light penetrated, the ceric salt was reduced and the paper changed colour. The image was developed by treating with some carbon compound of the aromatic series, forming an insoluble pigment with the unreduced ceric salt, and fixed by washing. In an acid solution the prints turned grey with phenol, green with aniline salts and orthotoluidine, brown with amidobenzoic acid, &c. The ceric salts are considerably more sensitive than the corresponding ferric and manganic salts.—Intense and rapid heating process by means of the electric current, by MM. Lagrange and Hoho. A bar of steel 1 cm. thick formed one electrode of a strong current passing through an electrolyte. The other electrode had a large surface. The heating was so rapid that, on breaking the current, the liquid suddenly cooling the bar was found to have imparted a brittle structure only to a superficial layer, the rest not having been heated (see also the *Bulletin* of the Belgian Academy).—On metallic osmium, by MM. A. Joly and M. Vezes (see "Notes").—Researches on thallium; redetermination of its atomic weight, by M. Ch. Lepierre.—On the fluorides of zinc and cadmium, by M. Poulenc.—Quantitative determination of mercury in dilute solutions of sublimate, by M. Léo Vignon.—Alkaline polyphenolic phenates, by M. de Forcrand.—Isomerism of the amido-benzoic acids, by M. Oechsner de Coninck.—Action of carbonic oxide upon reduced hæmatine and upon hæmochromogen, by MM. H. Bertin-Sans and J. Moitessier.—The toxic substance which produces tetanus results from the action of a soluble ferment produced by Nicolaïer's bacillus, by MM. J. Courmont and H. Doyon.—Action of cold on visceral circulation, by M. E. Wertheimer.—On the affinities of the genus *Oreosoma*, Cuvier, by M. Léon Vaillant.—On a new mineral species from Bamle, Norway, by M. Leopold Michel.—On a chloritoid schist of the Carpathians, by MM. L. Duparc and L. Mrazec.

BERLIN.

Physical Society, February 10.—Prof. du Bois Reymond, President, in the chair.—Dr. Raps exhibited and explained a photographic registration-apparatus which he had constructed, primarily for the purpose of obtaining a permanent record of the readings of the voltmeter at central electric stations, but which could also be used for meteorological and physical purposes. The principle of the instrument is as follows. Parallel rays from an incandescent lamp are made to fall on a narrow slit in front of which is the recording needle of the voltmeter or other instrument. The shadow of this needle then causes a white break in the dark image of the slit as cast on to sensitised paper. The paper is moved forward by clockwork, and the hour intervals are simultaneously printed on it by means of a rotating glass disc. The apparatus is arranged so as not to necessitate any dark chamber for its use, or for the manipulation of the sensitised paper. Prof. Kundt exhibited as lantern pictures two photographs of spectra, of which one showed very marked colours from the red to the violet end, and a photograph of some green twigs with red berries on them. The three photographs had been taken by Lippmann in Paris, and sent to Prof. von Helmholtz. Prof. Kundt then gave an account of some experiments carried on in his laboratory on the influence of temperature on electromagnetic rotation of light in iron, cobalt, and nickel. Trustworthy results

could only be obtained with nickel owing to the oxidation of the thin films of iron and cobalt at high temperatures (300°). With nickel a rise of temperature produced at first no change in the rotation, but above 300° a sudden diminution was observed which rapidly became progressively greater; the relationship of the diminution of rotation to the increase of temperature was the same as for the magnetic susceptibility of the metal.

February 24.—Prof. Schwalbe, President, in the chair.—Dr. Raps demonstrated his latest and most improved form of automatic gas-pump for blood-gas analysis. Dr. Richarz developed, in accordance with the kinetic theory of gases, and under certain assumptions as to the constitution of solid bodies, the formulæ for the law of Dulong and Petit. The formulæ furnished an explanation of the divergence from this law which is exhibited by certain elements. Dr. Gross spoke on the laws of energy, proceeding with his criticism of Clausius's views, stating that he regarded Clausius's second law as unproved, and finally coming to the conclusion that entropy is constant.

Physiological Society, February 17.—Prof. Zuntz, President, in the chair.—Dr. von Noorden gave an account of four experiments on nutrition carried out under his direction on men. The first established the fact that nitrogenous waste, as in the case of diabetes, even when excess of proteid is given, can be most definitely lessened by the ingestion of large quantities of carbohydrates. Fats cannot take the place of carbohydrates in the above. The second showed that when carbohydrates are given in increasing quantities over a prolonged period to a person in nitrogenous and calorimetric equilibrium, they lead for the most part to a storage of fat (95 per cent.), and to a less extent of proteid (5 per cent.). The speaker expressed the opinion that this proteid is laid on in the living cell as a sort of non-living reserve proteid. The third set of experiments showed that when the food of a fat person is diminished down to the requirements of a seven- to ten-year-old child, then any increase of its proteid constituents leads to a storage of proteid with a simultaneously considerable loss of fat. Experiments on the respiratory interchange of the person experimented upon showed that the intake of oxygen had been reduced to a minimum and that the respiratory quotient was 0·7. The last set of experiments, made on a gouty patient, showed that with a constant diet, the ratio of intake and output of nitrogen was very variable, at one time a large amount of nitrogen being retained in the body while at another time much more nitrogen was excreted than was given with the food.

AMSTERDAM.

Royal Academy of Sciences, February 25.—Prof. van de Sande Bakhuyzen in the chair.—Mr. Weber read a paper on the origin of the mammalian hair. The author gave a *résumé* of his earlier researches on the scales of mammals, which led him to the hypothesis that the primitive mammals were covered with true scales. A weak point in this hypothesis was, that except Manis and the Dasypodidæ, generally the tail alone is scaled. The author showed, however, that according to the researches of H. de Meyere, the arrangement of the hairs on scaleless skin of numerous mammals is the same as that in scaled parts. Both are placed in alternating groups. The author believed that primitive mammals were covered with scales, and that few and small hairs were placed behind them. On acquiring a constant temperature the hair coat got denser as a good protection from loss of heat. This was the cause of the reduction of the scales, and also mostly of their final loss.—Mr. Lorentz dealt with the influence of the motion of the earth on the propagation of light in doubly refracting media. In the September meeting the author communicated a simple form for the equations which determine the propagation of light in isotropic bodies, moving through the æther with a constant velocity p, the æther itself being supposed to remain at rest. It is now shown how these formulæ are to be modified in the case of a crystallised medium, and to what consequences they lead, as to the motion of light, relatively to the ponderable matter. The velocity of propagation of a *ray of light* (to be distinguished from that of the waves) is found to be $W = W_0 - \frac{p}{n^2}\cos\delta$, W_0 being the value for the same direction and for $p = o$, δ the angle between the ray and the velocity p, V the velocity of light *in vacuo*, and $n = \frac{V}{W_0}$. The course of reflected and refracted rays may be deduced from Huygens's principle or from the condition that $\int \frac{ds}{W}$ must be a minimum (ds being a linear element). Owing to the above value of W, the motion of the earth will neither affect the course of the rays nor the interference phenomena. In this way some experimental results of Ketteler (*Astronomische Undulationstheorie*, pp. 151–173, *Pogg. Ann* Bd. 147), and Mascart (*Ann. de l'Ecole normale*, 2e série, t. i. pp. 191–196) may be explained.—Mr. Kamerlingh Onnes gave the results of measurements of Dr. Zeeman on the dispersion of Sissingh's magneto-optic difference of phase in Kerr's phenomenon. The dispersion is contrary to the theory of Drude.—He described further a new entoptical phenomenon found by Dr. Zeeman in sighting a split, and communicated the results of the measurements of Dr. de Vries on the variation of the ascension of capillary tubes for æther with the temperature from − 102°C. to the critical temperature 193°·6. The surface work plotted in function of temperature gives a curve turning the convex side to the axis of temperature and ending tangentially to it.

BOOKS, PAMPHLETS, and SERIALS RECEIVED

BOOKS.—An Elementary Treatise on Pure Geometry: J. W. Russell (Clarendon Press).—Comité International des Poids et Mesures, Quinzième Rapport (Paris, Gauthier-Villars).—The Intelligence of Animals: G. W. Purnell (Christchurch, N.Z., Whitcombe and Tombs).—How to Improve the Physique: "Medicus" (Stock) Handbook of Jamaica, 1893 (Stanford).—Modern Meteorology: Dr. F. Waldo (Scott).—Gesammelte Abhandlungen über Pflanzen Physiologie: J. Sachs, Zweiter Band (Leipzig, Engelmann).—An Elementary Treatise on Modern Pure Geometry: R. Lachlan (Macmillan).—The Food of Plants: A. P. Laurie (Macmillan).—Elements of Physiography: Dr. H. Dickie (Collins).

PAMPHLETS.—Ueber die Bestimmung der Geographischen Länge und Breite und der Drei Elemente des Erdmagnetismus, &c.: Dr. H. Fritsche (St. Petersburg).—Diseases incident to Workpeople in Chemical and other Industries: W. Smith (Eyre and Spottiswoode).

SERIALS.—Himmel und Erde. Marz (Berlin, Paetel).—Revista Internazionale di Scienze Sociali e Discipline Ausiliarie, February (Roma).—Journal of the Chemical Society, March (Gurney and Jackson).—Annales de l'Observatoire de Moscou, deux série, vol 3, liv. 1 (Moscou).—Medical Magazine, March (Southwood).—Botanische Jahrbucher, Fünfzehnter Band, v. Heft (Williams and Norgate).—Transactions of the Wagner Free Institute of Science of Philadelphia, vol. 3, part 2 (Philadelphia).

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